



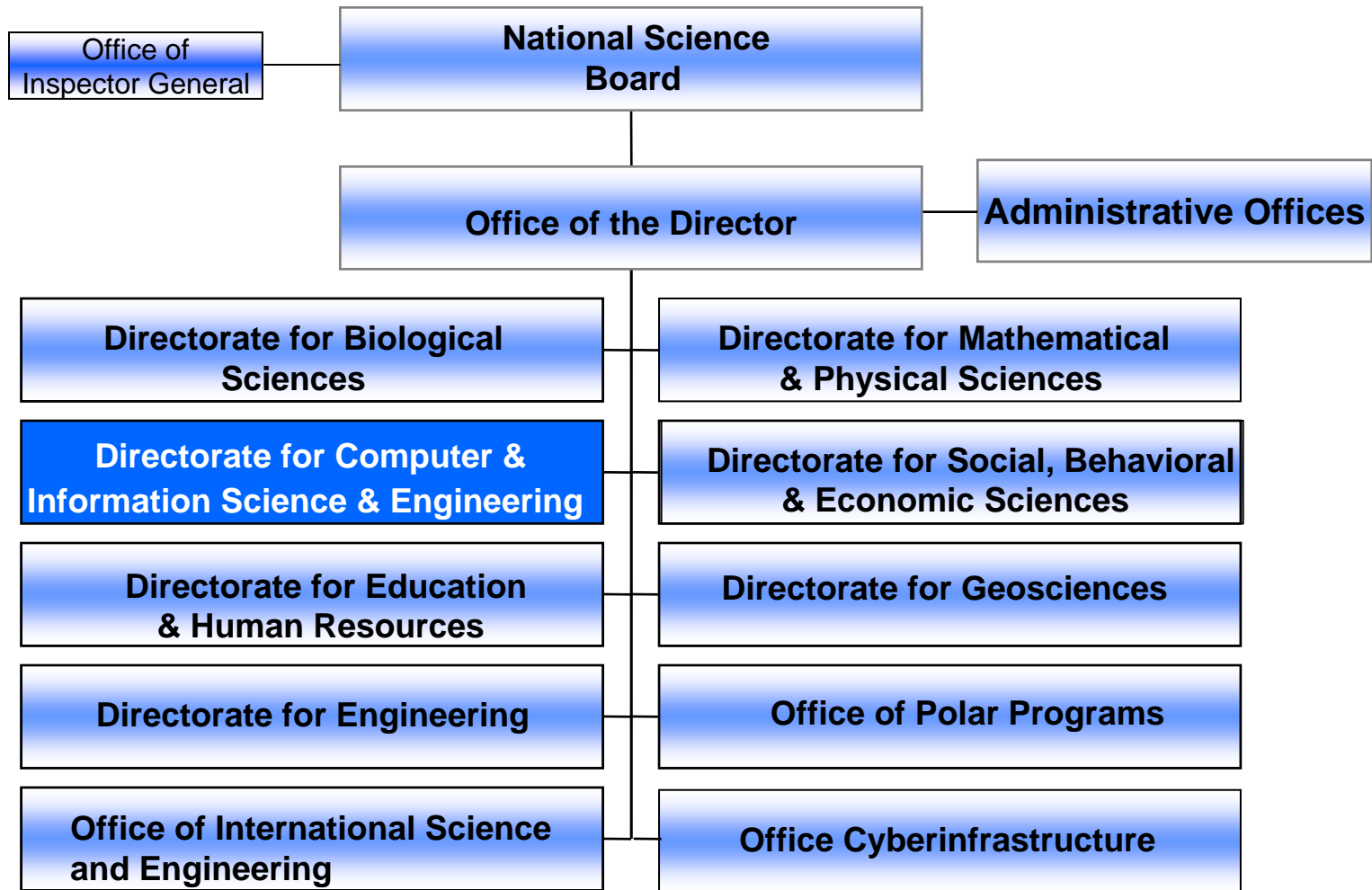
NSF Directorate for Computer & Information Science & Engineering (CISE)

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Directorate for Computer and Information Science and Engineering

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National Science Foundation





National Science Foundation

- Basic scientific research & research fundamental to the engineering process;
- Programs to strengthen scientific and engineering research potential;
- Science and engineering education programs at all levels and in all fields of science and engineering; and,
- A knowledge base for science and engineering appropriate for development of national and international policy



NSF Mission

To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes.



CISE Mission

- To enable the United States to remain competitive (*lead*) in computing, communications, and information science and engineering;
- To promote understanding of the principles and uses of advanced computing, communications, and information systems in service to society; and
- To contribute to universal, transparent, and affordable participation in an information-based society.



**CISE provides 86%
of all Federal support for
computer science research**



Computer Science Issues/Challenges

- CS research greatly impacts all areas of human activity
- Computing knowledge is broad, deep, and world-wide
- Academic workforce has grown significantly in 20 years, but not as fast as the interest in CS and breadth of work
- The role of CS research is poorly understood



CISE Strategic Objectives

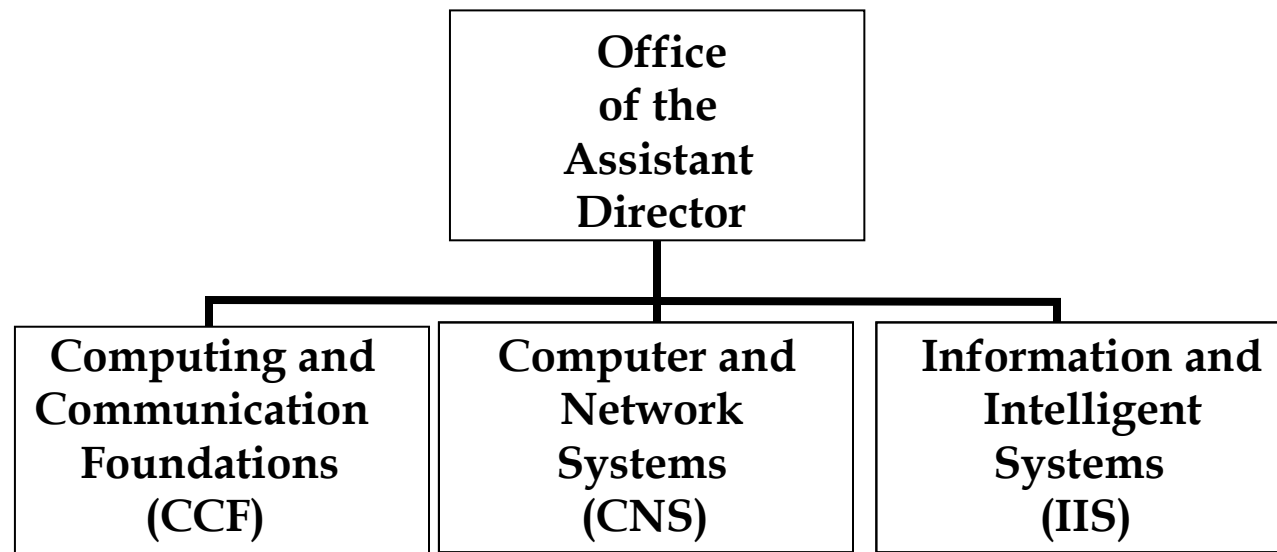
- Push the frontiers of Computer Science

Such as:

- Cybersecurity (Cyber Trust)
- Software productivity (Science of Design)
- Emerging models of computation
- Computer science theory
- Computing Community Consortium (CCC)
- New networking paradigms (GENI)
- Research for cyberinfrastructure
- Education & Workforce Preparation
 - Broadening Participation in Computing (BPC)
 - CISE Pathways to Revitalized Undergraduate Computing Education (CPATH)
 - National Center for Women and Information Technology (NCWIT)
- Improve organizational effectiveness (internal)



CISE Organization





Computing and Communication Foundations Division (CCF)

- Theoretical Foundations
 - Computer science theory; numerical computing; computational algebra and geometry; signal processing and communication
- Foundations of Computing Processes and Artifacts
 - Software engineering; software tools for HPC; programming languages; compilers; computer architecture; graphics and visualization
- Emerging Models and Technologies for Computation
 - Computational biology; quantum computing; nano-scale computing; biologically inspired computing



Computer and Network Systems Division (CNS)

- Computer Systems
 - Distributed systems; embedded and hybrid systems; next-generation software; parallel systems
- Network Systems
 - Networking research broadly defined plus focus areas
- Computing Research Infrastructure
 - Equipment and infrastructure to advance computing research
- Education and Workforce
 - IT workforce; special projects (BPC, CPATH); cross-directorate activities (e.g., REU sites, IGERT, ADVANCE)



Information and Intelligent Systems Division (IIS)

- Human-Centered Computing
 - Human-computer interaction; educational technology; universal access; computer-supported cooperative work; social and economic implications of IT
- Information Integration and Informatics
 - Databases; information retrieval; knowledge systems; information integration; X-informatics
- Robust Intelligence
 - Artificial intelligence; robotics; computer vision; text, image, speech, and video analysis; computational neuroscience

Also, special emphases in FY07 on information privacy and human-robot interaction



Computing Community Consortium: (CCC)

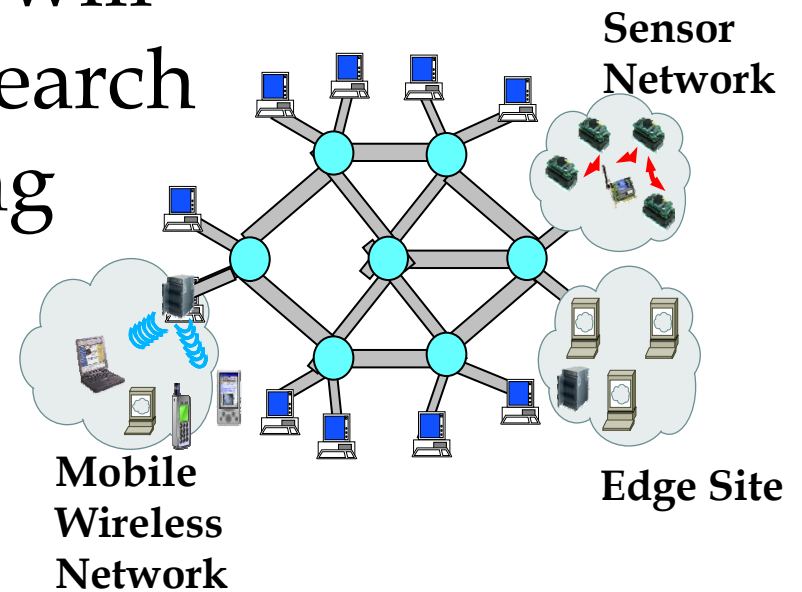
- Focuses on major, strategic computing efforts of fundamental/national importance:
 - Fundamental questions in computing
 - At-scale advanced applications
 - Transformational facilities
- Potentially addresses all priorities, but focus is on discovery research and facilities
- Serves as proxy to the computing research community



<http://www.cra.org/ccc/>

Global Environment for Networking Innovations (GENI)

- A global facility that will revolutionize the research process in networking and distributed systems





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WHERE DISCOVERIES BEGIN

CISE EMPHASIS AREAS



CISE Emphasis Areas

- Cyber Trust
- Science of Design
- Broadening Participation in Computing
- Global Environment for Networking Investigations (GENI)

Cyber Trust Emphasis Area

Vision

- A society in which...
 - Computing systems operate securely and reliably
 - Computing systems protect sensitive information
 - Systems are developed and operated by a well-trained and diverse workforce
- Research on foundations, network security, systems software, and information systems
- Integrated education and workforce activities



Science of Design Emphasis

- *About* Computing: computers, computation, information, communication
- *Not about*: buildings, bridges, airplane wings, traditional engineering design, nano, biotech, ..
- However: desirable to import design research from other fields
- How is “software” different from other materials from which artifacts are designed?
- How is design of (distributed, embedded, heterogeneous,...) systems different or the same as design of other artifacts?



Broadening Participation in Computing Emphasis

Vision

- A discipline in which
 - Graduates are well-prepared relative to a well-defined core of knowledge *and* are prepared for life-long learning
 - There are no under-represented groups
 - There is a strong and productive mix of domestic and foreign students and professionals
- Educational institutions, government organizations, and private sector work together to achieve the vision
- NSF's role is to seed efforts, enable model programs, dissemination, and research into success factors





GENI Emphasis

- GENI will provide a facility to explore new networking and distributed system architectures that, for example:
 - Build in security and robustness
 - Enable the vision of pervasive computing and bridge the gap between the physical and virtual worlds by including mobile, wireless, and sensor networks
 - Enable control and management of other critical infrastructures
 - Include ease of operation and usability
 - Enable new classes of societal-level services and applications



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NSF Cross-Cutting Activities



NSF Cross-Cutting Activities

- CAREER
- REU Sites/Supplements
- Advance
- IGERT
- GK-12



CAREER

- **Purpose**
 - To support early career-development activities of those teacher/scholars who most effectively integrate research and education within the context of the mission of their organization. Such activities should build a firm foundation for a lifetime of integrated contributions to research and education.
- **Potential Impact**
 - Supporting faculty who are most likely to become the academic leaders of the future



REU

- **Purpose**

- To support active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation.
- Two mechanisms for support of student research
 - *REU Sites* are based on independent proposals to initiate and conduct projects that engage a number of students in research. REU Sites may be based in a single discipline or academic department, or on interdisciplinary or multi-department research opportunities with a coherent intellectual theme.
 - *REU Supplements* may be requested for ongoing NSF-funded research projects or may be included as a component of proposals for new or renewal NSF grants or cooperative agreements.

- **Potential Impact**

- The development of a diverse, internationally competitive, and globally-engaged science and engineering workforce.
- The integration of research and education to attract a diversified pool of talented students into careers in science and engineering, including teaching and education research related to science and engineering.
- To ensure that these students receive the best education possible.



ADVANCE

- **Purpose**

- The goal of the ADVANCE program is to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce.

- **Potential Impact**

- Increased representation and advancement of women in academic science and engineering careers
- Increased diversity of the science and engineering workforce
- Increased numbers of underrepresented minority groups and individuals with disabilities



IGERT

- **Purpose**
 - To meet the challenges of educating U.S. Ph.D. scientists, engineers, and educators with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become in their own careers the leaders and creative agents for change.
- **Potential Impact**
 - Intended to catalyze a cultural change in graduate education – for students, faculty, and institutions – by establishing innovative new models for graduate education and training
 - Intended to facilitate greater diversity in student participation and preparation, and to contribute to the development of a diverse globally-engaged science and engineering workforce



GK-12

- **Purpose**
 - To provide funding to graduate students in NSF-supported science, technology, engineering, and mathematics (STEM) disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers in the 21st century.
- **Potential Impact**
 - Improved communication, teaching and team building skills for the fellows
 - Professional development opportunities for K-12 teachers
 - Enriched learning for K-12 students
 - Strengthened partnerships between institutions of higher education and local school districts



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NSF-wide Investments



NSF-Wide Investments

- **The NSF FY 2006 budget identifies 5 investment areas. Strengthening the capabilities in each of these areas will enhance the productivity and efficiency of the science and engineering enterprise while producing economic and social benefits for the nation.**
- **Investments:**
 - Cyberinfrastructure (CI)
 - Biocomplexity in the Environment (BE)
 - Human and Social Dynamics (HSD)
 - Nanoscale Science and Engineering (NSE)
 - Mathematical Sciences (MS)

Cyberinfrastructure

- **Purpose**
 - To provide user-friendly, reliable information technology and knowledge management resources to all researchers and educators to catalyze discovery at the frontiers of all science and engineering disciplines. With a well-established cyberinfrastructure, researchers will be able to access the world's highest-performance digital resources in order to tackle questions previously thought unapproachable because of their complexity or scope.
- **Potential Impact**
 - Over time, NSF investments will contribute to the development of a powerful, stable, persistent and widely accessible cyberinfrastructure to enable the work of science and engineering researchers and educators across the nation and around the world.



Biocomplexity in the Environment (BE)

- **Purpose**
 - To understand complex environmental systems in which the dynamic behavior of living organisms is linked to the physical and chemical processes of the environment.
- **Potential Impact**
 - A better understanding of natural processes, human behaviors and decisions in the natural world, and ways to use new technology effectively for environmental sustainability
 - Improved forecasting capabilities
 - Enhanced understanding of environmental decision-making
 - Novel sensor systems and instrumentation
 - A more comprehensive understanding of the ecology of infectious diseases
 - Improved environmental education



Human & Social Dynamics (HSD)

- **Purpose**

- To foster breakthroughs in understanding human action and development, as well as knowledge about organizational, cultural and societal adaptation and change. Potential Impact

- **Potential Impact**

- Better anticipation of change, including human causes and responses
- Improved human interactions in various settings ranging from research laboratories to elementary classrooms
- Better understanding of risk assessment, testing in the face of biases, distributed versus centralized decision-making, and risks posed by extreme events
- Comprehension of how social systems and their parts react to a variety of drivers, ranging from war and ideology to the Internet and home computers
- Enhanced decision-making in the face of changing risks and uncertainty



Nanoscale Science and Engineering (NSE)

- **Purpose**

- To provide a better understanding of nature, the development of novel products, improved efficiency in manufacturing, sustainable development, better healthcare and improved human performance

- **Potential Impact**

- Improved human health (including individualized pharmaceuticals, novel drug delivery systems and enhanced gene therapy)
- Novel nanoscale and nanostructured materials (i.e., more resilient materials and fabrics and biocompatible nanostructured materials for implantation)
- New and improved approaches to environmental sustainability (e.g., material and energy conservation)
- Next-generation instrumentation and infrastructure (including faster computer chips and novel nanoelectronics)

Mathematical Sciences

- **Purpose**
 - To advance research across disciplines and train a mathematically literate workforce.
- **Potential Impact**
 - Improved analysis of huge amounts of data from scientific instruments (e.g., genetic research, earthquake sensors and weather observations)
 - Better models for complex phenomena (e.g., electrical patterns in the brain and heart, economic activity in society and information flow in computer networks)
 - Improved forecasting of extremely complicated outcomes (e.g., climate patterns, air traffic control and electrical power grids)
 - Improved decision-making tools for Internet-based business information systems
 - More competitive U.S. workforce underscored by mathematics and statistics education

Resources at your Disposal

- MyNSF (<http://www.nsf.gov/mynsf/about.cfm>)
 - MyNSF is available to anyone wishing to know about new content on the NSF website
 - Automatically emails notices of special announcements, newly released solicitations, and other funding opportunities
- Grant Proposal Guide (GPG)
 - Provides guidance for preparation and submission of proposals to NSF
 - Describes process and criteria by which proposals will be reviewed and managed
- Awards Search
 - Information about research projects that NSF has funded since 1989
 - Abstracts that describe the research, and names of principal investigators and their institutions.
 - The database includes both completed and in-process research
- Guide to Programs
 - A compilation of funding opportunities offered by the National Science Foundation (NSF) for research and education in science, mathematics, engineering, and technology.
 - The *Guide* includes broad, general descriptions of programs and activities for each NSF Directorate, as well as sources for more information.



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Proposal Preparation



What Makes a Proposal Competitive?

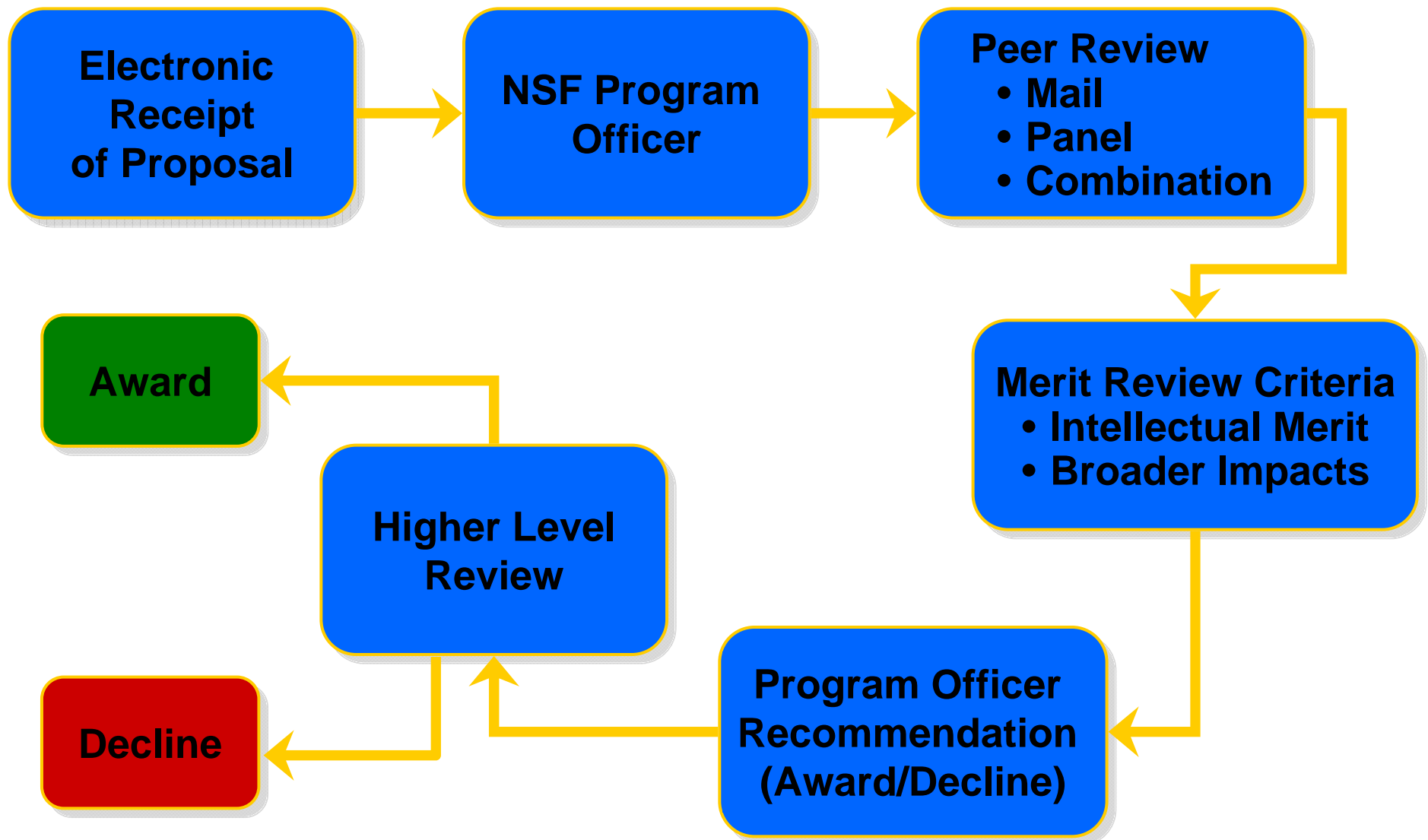
- Likely high impact
- New and original ideas
- Succinct, focused project plan
- Knowledge of subject area or published, relevant work
- Experience in essential methodology
- Clarity concerning future direction
- Sound scientific rationale
- Realistic amount of work
- Sufficient detail
- Critical approach



Reasons for Funding a Competitive Proposal

- Likely high impact
- PI Career Point
(tenured? / "established" / "young")
- Place in Program Portfolio
- Other Support for PI
- Impact on Institution/State
- Special Programmatic Considerations
- Diversity Issues
- Educational Impact
- "Launching" versus "Maintaining" or "Incrementalism"

NSF Merit Review Process



NSF Merit Review Criteria

Criteria include:

- **What is the intellectual merit and quality of the proposed activity?**
- **What are the broader impacts of the proposed activity?**



What is the intellectual merit of the proposed activity?

Potential Considerations:

- How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
- How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, reviewers will comment on the quality of prior work)
- How creative and original are the concepts?
- How well conceived and organized is the proposed activity?
- Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

Potential Considerations:

- How well does the activity advance discovery and understanding while promoting teaching, training and learning?
- How well does the activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?

Help from the Community

- Send your best ideas to NSF
 - Consistent with focus & goals of the program
 - We want high risk / high reward proposals
- Volunteer to be a reviewer / panelist

NSF is looking for good reviewers/panelist.
This is a very rewarding activity!



Conclusion

- NSF's role is fundamental to all areas of our society – the most basic future investment
- Computer Science and related disciplines are very important in their own right and essential to advancement in all areas of S&E
- NSF is facing unprecedented pressures so we must be strategic in our investments and activities



NSF has a unique responsibility to the Nation to advance computing research



Contact Information

Visit the CISE Web site at:

<http://www.nsf.gov/dir/index.jsp?org=CISE>